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REMARKS

As an initial matter, Applicants gratefully acknowledge the Examiner's determination that the subject matter of claim 12 is allowable (Office Action, September 8, 2003, page 4, lines 19-22).

Claims 1-3 and 6-12 are canceled without prejudice, claim 4 is amended, and new claims 13-16 are added.

Specifically, claim 4 has been amended to incorporate the wafer size limitation of claim 6 and to recite "exposing the composition using i-line monochromatic light as a light source by an i-line stepper" as supported in the specification on page 35, lines 20-22. It is well-known in the art that i-line light is inherently monochromatic, "i-line" referring to a line in the mercury spectrum. No new issue is raised because the examiner has already considered an i-line stepper (Office Action dated September 8, 2003, page 3, lines 17 and 21).

New claims 13-16 have been added, depending on claim 4 but otherwise consisting of the subject matter of prior claims 3, 10, 11, and 12, respectively.

The present amendment adds no new matter to the application and raises no new issues.

The Invention

The present invention is directed to a method which can form a protective polyimide film pattern with high reliability on circuits of chips formed on a wafer having a size of at least 12 inches. Importantly, the polyimide has low stress and causes substantially no warpage on the large-sized silicon wafer. Moreover, even when an i-line with the short wavelength of 365 nm is used for exposure, the invention provides excellent transparency,

so as a result a good pattern shape with high resolution can be formed on the chips on a large sized wafer. Accordingly, the invention has the advantage that semiconductor devices with high reliability and less failure of the respective chips can be produced with a higher yield, while simultaneously enjoying the full advantages of a large wafer size (such as obtaining a large number of chips from one wafer). One of the most important characteristics of the present invention resides in using a photosensitive composition which can form a polyimide film having a specific i-line transmittance and a specific residual stress, and effecting a step of i-line monochromatic light exposure using a large sized wafer of 12 inches or more.

The Rejections

Claims 1-4, 10, and 11 stand rejected under 35 U.S.C. 103(a) as unpatentable over Tanaka et al. (EP 0702270 A2, "Tanaka") in view of Hagiwara et al. (EP 0738745 A1, "Hagiwara"). Claim 6 stands rejected under 35 U.S.C. 103(a) as unpatentable over Tanaka in view of Hagiwara, and further in view of Tanabe et al. (U.S. Patent 6,428,399, "Tanabe").

Applicants respectfully traverse the rejection and request reconsideration for the following reasons.

Applicants' Arguments

As an initial matter, claim 16 is allowable for the reasons of record, namely because it contains all of the limitations of claim 12, which has been deemed to contain allowable subject matter (Office Action, September 8, 2003, page 4, lines 19-22).

The References Are Not Combinable

The combination of the Tanaka and Hagiwara references is inappropriate because the references are not combinable to reject the claims as presently amended. Where claimed subject matter has been rejected as obvious in view of a combination of prior art references, a proper analysis under § 103 requires that (1) the prior art must suggest to those of ordinary skill in the art that they should perform the invention; and (2) the prior art must have revealed a reasonable expectation of success in performing the invention. In re Vaeck 20 U.S.P.Q.2d 1438, 1442 (Fed. Cir. 1991). The relied-upon references do not meet this burden: the references do **not** suggest the proposed combination and the references do **not** suggest that such a combination would work. Moreover, the composition of Tanaka is not operable for i-line exposure, and the composition of Hagiwara in all likelihood creates a high residual stress and therefore cannot be applied to a large-size (12 inch) wafer. Therefore Applicants respectfully traverse the rejection and request reconsideration.

The Tanaka reference discloses photosensitive resin compositions. The Examiner admits that the Tanaka reference does not teach that the polyimide deposited on a substrate would have “a transmittance of at least 5% at a wavelength of 365 nm” or that “the light source used for exposure are i-lines” (Office Action dated December 19, 2002, page 3, lines 9-12). Applicants agree that the reference fails to teach these limitations. As indicated above, Tanaka does not suggest operation of the Tanaka invention with an i-line light source, and especially does not suggest that operation with an i-line light source would have a reasonable chance of success. Therefore the burden for combinability under Vaeck is not met. Combination of the Tanaka reference with another reference teaching an i-line light source is essential to the rejection, and because such combination is not possible, applicants request withdrawal of the rejection.

In fact, the invention of Tanaka simply **will not work** with an i-line light source. Example 1 of Tanaka is carried out by a PLA-501F (page 15, lines 8-10), an instrument which exposes a material to a wide range of wavelengths, and is not at all intended to generate i-line monochromatic light. Moreover, in Example 2, a wavelength of 465 nm, or g-line light, is described (page 15, lines 28-29). Finally, the specific precursors described in Tanaka have such low transmittance to i-line light, especially in comparison to the present invention, that it would be essentially impossible to form a useful pattern using the Tanaka invention with i-line light. Although these facts are dispositive in refuting the obviousness rejection, they are not necessary, because the references fail to meet the Vaeck burden for combinability and therefore the reference cannot establish a prima facie case of obviousness.

The Hagiwara reference discloses a polyimide precursor. The polyimide precursor disclosed by the Hagiwara reference is alleged to be particularly suitable for forming patterns using an i-line stepper (Abstract). However, the Hagiwara reference is silent with respect to the residual stress properties of the films formed using the disclosed polyimide precursor. A low residual stress is essential to success in employing a large wafer size. Therefore, in all likelihood, and unlike the present invention, Hagiwara cannot be applied to a large size wafer. Regardless, Hagiwara does not (1) teach using the Hagiwara teaching on a large wafer, nor (2) indicate a reasonable expectation of success in using the Hagiwara teaching on a large size wafer as presently claimed. Therefore, Hagiwara is not combinable with teachings of a large wafer size as presently claimed.

The Tanabe reference teaches a large size wafer, but not the other elements of the claims. Tanabe does not teach the desirability, or the likelihood of success of combining

U.S. Serial No. 10/012,462.

any of the references to obtain the present invention. Therefore, the Tanabe reference does **not** remedy the faults of the prior references and does not establish a prima facie case of obviousness.

In conclusion, because (1) the references themselves do **not** teach to those of ordinary skill in the art that they should perform the invention; and (2) the references themselves do **not** reveal a reasonable expectation of success in performing the invention, the cited references do not establish a prima facie case of obviousness. 20 U.S.P.Q.2d at 1442, see also ACS Hospital systems, Inc. v. Montefiore Hospital 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984) (“Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination.”).

Conclusion


For all of the above reasons, claims 4 and 13-16 are in condition for allowance, and a prompt notice of allowance is earnestly solicited.

U.S. Serial No. 10/012,462

Questions are welcomed by the below signed attorney of record for the Applicants.

Respectfully submitted,

GRIFFIN & SZIPL, PC



Joerg-Uwe Szimpl
Reg. No. 31,799

GRIFFIN & SZIPL, PC
Suite PH-1
2300 Ninth Street, South
Arlington, VA 22204

Telephone: (703) 979-5700
Facsimile: (703) 979-7429
Customer No.: 24203